Observational Model for the Space Interferometry Mission

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Abstract

The Space Interferometry Mission (SIM) is a space-based long-baseline optical interferometer for precision astrometry. One of the primary objectives of the SIM instrument is to accurately determine the directions to a grid of stars, together with their proper motions and parallax, improving a priori knowledge by nearly three orders of magnitude. The basic astrometric observable of the instrument is the pathlength delay, a measurement made by a combination of internal metrology measurements that determine the distance the starlight travels through the two arms of the interferometer and a measurement of the white light stellar fringe to find the point of equal pathlength. Because this operation requires a non--negligible integration time to accurately measure the stellar fringe position, the interferometer baseline vector is not stationary over this time period, as its absolute length and orientation are time-varying. This conflicts with the consistency condition necessary for extracting the astrometric parameters which requires a stationary baseline vector. This paper addresses how the time-varying baseline is "regularized" so that it may act as a single baseline vector for multiple stars.

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